EAST BAY SEWERS: PROBLEMS, SOLUTIONS, GOALS

Summary Report of Findings and Recommendations from the East Bay Infiltration/Inflow (I/I) Study

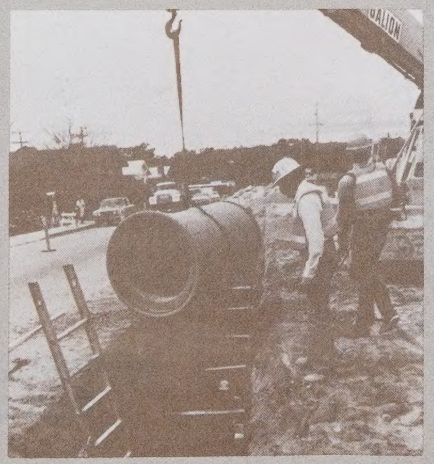
EAST BAY INFILTRATION/INFLOW CORRECTION PROGRAM

ALAMEDA
ALBANY
BERKELEY
EMERYVILLE
OAKLAND
PIEDMONT
STEGE SANITARY DISTRICT

Remember those manholes that spout sewage and stormwater several times a year during our heaviest rains? Who can forget? Certainly not the cities served by EBMUD's wastewater system, which now are poised to begin a long-term, multi-million-dollar program of modernizing their sewers.

Not only do chronic wet-weather sewer overflows threaten public health and the waters of the Bay, but they are in violation of several state and federal regulations.

Accordingly, the cities of Alameda, Albany, Berkeley, Emeryville, Oakland, Piedmont and the Stege Sanitary District which includes El Cerrito, Kensington and part of Richmond—all the members of EBMUD's Special District No. 1—banded together to analyze their serious rainfall-caused



The five-year analysis, formally known as the East Bay Infiltration/Inflow (I/I)

diluted, untreated sewage can overflow during a single storm. This illustrates the extensive deterioration of the 3,400-mile sewer system, and shows why the communities are acting now before the problem gets worse.

The I/I Study recommended a 20-year correction program involving repair and replacement of existing sewers and construction of new capacity in each city. In all, nearly half of the sewers throughout the service area will be rehabilitated, and 84 miles of new sewers will be built.

Each community has submitted compliance plans to the Regional Water Quality Control Board, detailing the first five years of work and scheduling the priority jobs throughout the whole 20-year program.

$16.5 million study, they've identified what parts of their sewer network need replacing, what can be repaired, and how to go about this huge job at the least cost.

THE PROBLEM

Correction won't be easy, inexpensive or quick. At present, EBMUD's wastewater system serves about 600,000 residents and 7,000 businesses and industries in an 83-square-mile area. Their wastewater is collected by more than 3,400 miles of private and city-owned sewers and delivered to the EBMUD interceptor pipeline for transportation to the District's treatment plant near the Bay Bridge. Nearly half that sprawling system must be repaired, and miles of new, larger sewers must be built.

THE CAUSES

In the East Bay, separate systems exist for wastewater (sanitary sewage) and rainwater. During wet weather, leaky pipes allow stormwater to infiltrate and overload the wastewater system. In the biggest storms, flows can swell to 20 times the amounts in dry weather. And in some places, 50% of the rainfall enters deteriorated and leaky sanitary sewers, causing manholes to overflow into streets and creeks.

From at least 175 known points in the East Bay, 190 million gallons of rain-

sewer renovations to remedy the causes of wet-weather overflows. EBMUD will act as the coordinating agency for the regional correction program now getting underway.

public hearings and incorporated suggestions into a final Environmental Impact Report on the overall program. Individual projects will be reviewed annually to insure that environmental impacts are controlled.

THE PRICE TAG

Costs are expected to total over $400 million for the communities' 20-year construction program. Related costs for improvements to EBMUD's system could total an additional $200 million. Costs to repair sewers on private property (lines from the home to the street sewer) could add another $100 million to the program. Altogether, the lowest cost to fix the badly deteriorated, overage regional system could approach $700 million.

Grants, loan programs, and revenue plans are being developed to distribute costs equitably and to ease the effect on homeowners. By itself, reauthorization by Congress of the federal Clean Water Act could produce $15 million in grant funding for the first year's construction.

Nevertheless, users' charges unavoidably will go up. Soon, if not already, individual homeowners should see an increase in their fees ranging from $1 to $5 a month, depending on the particular construction projects and financing arrangements of each city. Eventually, as the program reaches its peak and heads for completion, user fees should approach $20 a month.

If you have questions, comments or suggestions, please call the East Bay I/I Correction Program at 465-3700, ext. 227, or call your own community at the number listed below.

Alameda	522-4100, ext. 272
Albany	528-5760
Berkeley	644-6540
Emeryville	658-8732
Oakland	273-3437
Piedmont	420-3050
Stege Sanitary District	524-4667

You can also help by reporting sewer overflows to your community Public Works Department. Your participation is an important part of locating needed improvements.

EAST BAY INFILTRATION/INFLOW CORRECTION PROGRAM

P.O. Box 24055 Oakland, CA 94623 (415) 465-3700

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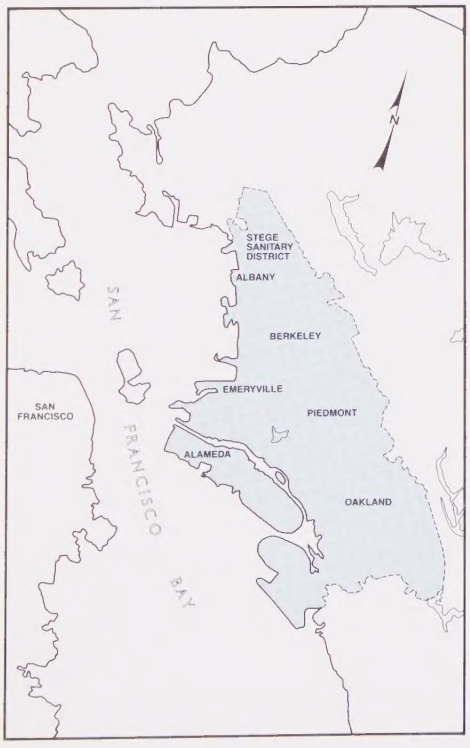
EAST BAY SEWERS: PROBLEMS, SOLUTIONS, GOALS

Summary Report of Findings and Recommendations from the East Bay Infiltration/Inflow (I/I) Study

INTRODUCTION



Over the last 10 years our nation has made a significant commitment to environmental protection, investing approximately $40 billion in federal water quality programs alone. Most of this money has been spent to build or improve wastewater treatment facilities. Relatively little has been spent on building or improving the sewers that carry wastewater to the treatment facilities. Today, one of our nation's greatest water quality problems is due to the gradual deterioration of sewer systems resulting from inadequate maintenance and replacement. This key element of the urban infrastructure has been neglected and parts of the system kept in service beyond their useful life. Studies indicate that tremendous amounts of stormwater and groundwater enter deteriorated sanitary sewers, causing sewer overflows upstream of treatment facilities, disruption of treatment processes, and higher operating costs.

Here in the East Bay, the sanitary sewer systems are valued at over $8 billion. Recent studies show that an investment of nearly $425 million may be needed over the next 20 years to rehabilitate, replace, or upgrade the systems to meet current environmental and public health standards. This investment will require a dramatic increase in local sewer user charges and connection fees.

What are the problems and how do we solve them? The purpose of this booklet is to help answer these questions. The following pages provide some useful information for East Bay decision-makers concerned with the long-term operation and maintenance of our sanitary sewer systems.

East Bay Sewers

1986 District wet weather facilities plan updated. Communities amend JPA to begin East Bay Infiltration/Inflow (I/I) Correction Program.

1985 East Bay I/I Study completed. Compliance plans for 20-year sewer improvement and correction program filed with RWQCB.

1981 District wet weather facilities plan.

1980 East Bay Infiltration/Inflow (I/I) Study begins.

1979 Joint Powers Agreement (JPA) for community overflow study.

1977 NPDES Permits renewed. Secondary treatment for wastewater begins.

1975 Special District No. 1 staff and communities joint report "Control of Wet Weather Overflows and Bypasses."

Regional Water Quality Control Board (RWQCB) issues NPDES Permits requiring District and communities to correct overflow problem.

1970 Stege Sanitary District annexed. $60 million bonds voted for secondary treatment.

1951 Special District No. 1 system: interceptors, primary treatment plant, deep water disposal.

1946 $24.5 million bond issue voted.

1944 Special District No. 1 created under EBMUD.

1940 Cities join to study wastewater disposal problem.

1936 Bay Bridge completed. Serious water pollution and odor problems obvious.

1885 First sewers completed.

BACKGROUND AND SUMMARY OVERVIEW

Brief History of East Bay Sewers

When East Bay sewers were constructed in the 19th and early 20th centuries there was little centralized planning and no sewage treatment. By the 1930's, more than 30 major East Bay sewers flowed directly into San Francisco Bay, San Leandro Bay and the Oakland Estuary.

Foul shoreline odors became noticeable and offensive to the general Bay Area public when the San Francisco-Oakland Bay Bridge and approaches opened the eastshore to travel. Public outcry about the stench on the shoreline prompted a 1940-41 region-wide study of the East Bay sewage disposal problem.

This study recommended building large pipelines along the shoreline to "intercept" the community collection sewers and prevent discharges of raw sewage to the shoreline waters, mudflats and marshes. These interceptors were to transport all the wastewater to a central location for treatment and proper disposal.

World War II delayed action on the 1941 recommendations, and the large wartime population increase made conditions worse. Then, in 1944, the six East Bay cities of Alameda, Albany, Berkeley, Emeryville, Oakland and Piedmont voted overwhelmingly to create Special District No. 1 as a subdivision of the East Bay Municipal Utility District (EBMUD) responsible for interception and treatment of sewage.

EBMUD updated the earlier studies in 1945-46 and recommended a project including the bayshore interceptor system, a primary treatment plant near the San Francisco-Oakland Bay Bridge toll plaza, and a disposal pipe for treated wastewater reaching out to the 45-foot depth of San Francisco Bay. The recommendations included separating storm and sanitary sewers.

Significantly, the EBMUD planners foresaw a problem if stormwater and groundwater were not kept out of the sanitary sewer systems. They recommended that the District and communities adopt and enforce regulations that would require:

- close supervision of private building sewer lateral construction to ensure water tightness;
- inspection and testing of sewers built by developers;
- eliminating direct storm drain connections to the sanitary sewer systems;
- separating all existing combined storm and sanitary sewers.

In 1946, voters in the six communities of EBMUD's wastewater service area approved a $24.5 million bond issue to build the recommended project. Construction started in 1948 and was completed in 1951.

In 1970 the Stege Sanitary District, consisting of El Cerrito, Kensington and parts of Richmond, was added to Special District No. 1. Also in 1970, the District's voters responded to new environmental concerns and approved a $60 million bond issue to upgrade the treatment plant with an added level of treatment. The new secondary treatment plant began operating in 1977.

Today, Special District No. 1 serves approximately 572,000 residents and more than 15,000 industries and businesses in an 83-square-mile area. Approximately 2,000 miles of private building sewer laterals connect to over 1,400 miles of sanitary sewers owned and operated by the seven communities in the District. The community sewers

discharge to the District interceptor system—22 miles of large-diameter pipelines and 13 pumping stations near the shoreline. In wet weather, the District's Wastewater Treatment Plant can provide primary treatment for 300 million gallons per day and secondary treatment for 170 million gallons per day. Dry weather flows average 85 million gallons per day and receive full secondary treatment.

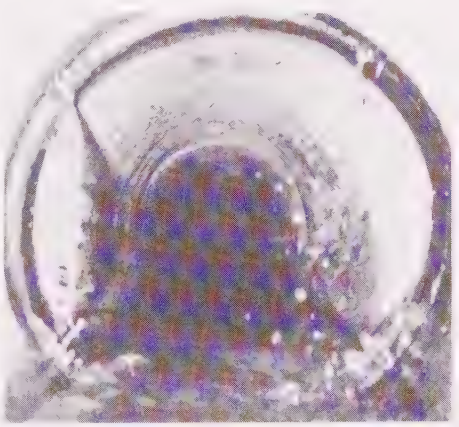
Community Collection Systems

Each community in the District service area continues to own and operate its own collection system. Until the regional interceptor system and treatment plant were built in 1951, the community systems simply collected sanitary waste and discharged untreated wastewater directly to the bay at the shoreline. Now the community collectors discharge to the District interceptor near the shoreline and the flow is transported to the Wastewater Treatment Plant near the Oakland Army Base.

The community systems also include the private building sewers, called "laterals", which connect buildings to public sewers and which each building owner owns, operates and maintains. Each community defines owner responsibility somewhat differently. In Oakland and Stege for example, the building owner has historically been responsible for the entire sewer lateral from the building to the sewer main generally located in the middle of the street. In the other East Bay communities, the owner is responsible only from the building to the property line and has no responsibility for the portion of the lateral in the public street or easement.

The community collection systems were installed in a piecemeal fashion by developers without proper inspection and quality control. Pipe sections were often as short as 2 feet and there were many joints. The old fashioned "oakum" joint sealer (used to caulk wooden sailing ships) has long since given way and these old pipelines are no longer watertight. Many of the original building lateral connections were not installed with fittings but inserted through holes broken or chipped into the main pipe. In some cases, the protruding sewer lateral stubs, break-in holes, and leaky, root-infested joints are troublesome wet weather reminders of those antiquated building practices. These typical conditions are widespread and defective laterals are the major East Bay problem.

Today the communities inspect all new sewer construction and require conformance to rigorous code standards designed to protect the public health. New fittings, new sealants and better building materials are available now. Inspection and testing methods make code enforcement easier and ordinary sewer building practices are done with care.



A TV camera shot taken during a rainstorm shows stormwater pouring into a sanitary sewer pipe through a bad joint. Millions of gallons of stormwater get into East Bay sanitary sewers in this way during wet weather. These extra flows result in overflows of dilute raw sewage into community streets, watercourses and San Francisco Bay.

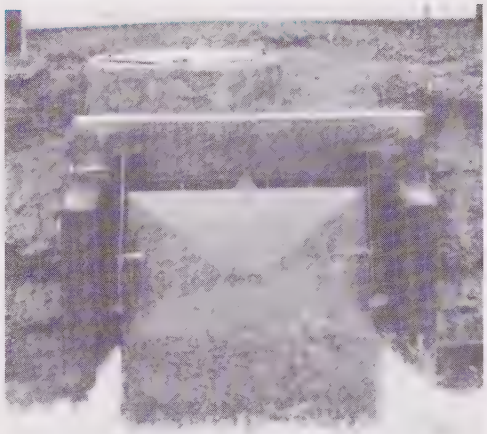
WET WEATHER PROBLEMS

I/I problems cause dilute raw sewage to overflow from Regional and Community sewers.

Below left: District overflow structure on the Interceptor at Elmhurst Creek near the Coliseum.

Below right: Community sewage flows swollen with I/I overflows at manhole.

East Bay sewer systems generally work well during the dry season, but during wet weather there is an overflow problem. In the East Bay, separate systems exist for wastewater (sanitary sewage) and stormwater. During wet weather, leaky pipes allow stormwater to infiltrate and overload the wastewater system. In the biggest storms, flows can swell to 20 times the amounts in dry weather.



Infiltration/Inflow (I/I)

The technical term for groundwater and stormwater which enter sanitary sewers is "infiltration/inflow". This extraneous water enters sanitary sewers primarily through defective pipes. Improper storm drain connections are also a problem, but to a lesser extent.

Infiltration is water which enters the system from the soil surrounding pipes, manholes and other buried structures. Infiltration enters through defects such as breaks, cracks, or open pipe joints. Often private building sewer laterals are poorly maintained and allow significant amounts of infiltration. Over 90 percent of peak flows result from rainfall derived infiltration (RDI). RDI acts much like inflow, with very rapid peak flows following a rainstorm.

Inflow is water which enters the sewer system through improper direct connections such as downspouts, yard drains and sump pumps tapped into private building sewer laterals. Manholes submerged in flooded streets and storm drains cross-connected to sanitary sewers are other sources of inflow. Inflow causes less than 10% of the peak wet weather flows.

During mid-winter an average of more than 18% of the rain falling on the District service area gets into the sanitary sewer systems as Infiltration/Inflow (I/I). In some areas more than 50% of the rainfall becomes I/I. Flow in some sewers increases **twenty times**. Most stormwater entering the collection system is due to rainfall-derived infiltration. RDI is, in effect, infiltration that acts like inflow. The extensive RDI in the service area is the result of serious widespread sewer system deterioration.

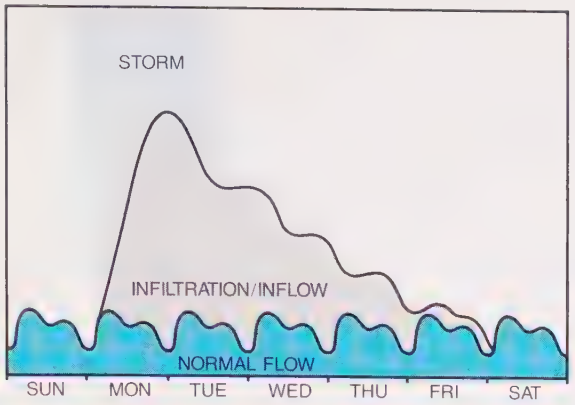
- Altogether more than 180 million gallons of I/I diluted wastewater overflows from the East Bay sewer systems in a typical winter. During very wet winters, like those in 1981-82 and 1982-83, overflow volumes have been estimated at over one billion gallons.

- Excessive I/I forces the District's interceptors to overflow at one or more of seven shoreline locations approximately ten times each year. These overflows discharge I/I diluted wastewater without treatment into San Leandro Bay, the Oakland Estuary and the eastern shoreline of San Francisco Bay.

- In addition to the interceptor overflows, more than 175 known wet weather overflow locations in the community sewer systems have been identified. Each winter these overflows, predominantly manholes, dump dilute raw sewage into East Bay streets, storm drains and creeks. This illustrates the extensive deterioration of the 3,400-mile sewer system.

- Nearly 25% of the wastewater treated in a typical year is I/I. This amounts to 7 billion extra gallons to process at a cost of $1-2 million.

- In the early 1970s, the California Regional Water Quality Control Board, San Francisco Bay Region, issued National Pollutant Discharge Elimination System (NPDES) permits to EBMUD and to the Special District No. 1 communities. The EBMUD permit requires eliminating untreated overflows from the Wastewater Treatment Plant and the interceptor system. The community permits require eliminating overflows and bypasses from their local sewer systems.



Hydrograph shows normal daily wastewater flows at bottom. Rainfall derived I/I from a rainstorm causes dramatic increases in wastewater flows lasting several days.

East Bay Infiltration/Inflow Study

EBMUD and the Special District No. 1 communities made a coordinated response to the NPDES Permit requirements. This response was outlined in a 1975 report prepared for Special District No. 1 called: **"Control of Wet Weather Overflows & Bypasses"**.

The communities joined together in 1979 to carry out the East Bay Infiltration/ Inflow Study under a Joint Powers Agreement which designated EBMUD as lead agency. The Study's purpose was to develop solutions for the community overflow problems.

The I/I Study was funded under the Clean Water Grant Program with state and federal support paying 87.5% of the costs. The 12.5% local share was paid by the communities. As lead agency, EBMUD provided management, administrative and accounting services; the costs for these were reimbursed by the communities served.

Meanwhile, in 1980, EBMUD completed a Wet Weather Facilities Plan–a plan for improvements to the interceptor system, which along with the community efforts to reduce I/I, was expected to control the interceptor overflows.

Study Findings

Initially, it was thought the extra water causing the I/I problem was inflow which would be relatively simple to correct. Disconnecting roof downspouts, yard drains, and storm drains that were improperly connected to the sanitary sewers was supposed to solve the problem. The I/I Study did find some inflow connections, but estimated that they account for less than *ten* percent of the extra water measured.

As data from flow monitors, rain gauges, smoke testing, television inspection and dye tracing was analyzed it became clear that the community sewers are severely deteriorated. Infiltration is the main problem. It is difficult and expensive to correct infiltration problems because only comprehensive rehabilitation will solve the problem.

Storm water percolates through the soil and gets into the leaky system everywhere. So much extra water pours in East Bay sewers during wet weather that it causes backups and overflows in many places. Excess storm water can disrupt treatment processes at the regional Wastewater Treatment Plant. This wet weather situation has created a public health and water pollution concern in the East Bay area.

East Bay sewers are 30 to 100 years old, and both public main lines and private laterals are seriously deteriorated. More than 50% of the system is beyond normal life expectancy, creating a substantial backlog of construction and repair needs.

Collection system pipes should lie in firm bedding soil, follow uniform slopes and be water-tight. Typical East Bay sewers no longer meet these criteria. Instead, they slump or sag, have offset joints or missing joint sealant, connections are broken and pipe cavities filled with roots. In some cases, just as storm water can leak in, raw sewage can also leak out and flow downhill in the sewer trenches. Such leaking overflows will erode the pipe trench bedding; eventually the pipes can collapse into these eroded voids and leave potholes in the street.

Many problems are caused by I/I in the East Bay. In a typical day each person in the East Bay produces 50 to 100 gallons of wastewater, or about one bathtub full of water per day. When it rains, I/I can add 500 to over 1,000 gallons per person per day!

The I/I Study also found that typical older private sewers in the East Bay are in just as poor condition as are the public sewers. The privately owned sewer laterals cause more than 60% of the problems. Both public and private parts of the system must be rehabilitated at the same time; only comprehensive rehabilitation will be effective. Once repairs are made and hydraulic bottlenecks and restrictions are eliminated, a long-term preventive maintenance program will be needed to prevent future I/I problems.

How much is one billion gallons? It is enough water to fill 10 tanks as big as the Oakland Coliseum Arena. The EBMUD Wastewater Treatment Plant treats about 30 billion gallons of wastewater in a year, enough to fill 300 arena-sized tanks. More than 7 billion gallons of this is groundwater and stormwater (I/I) that should not be in the sanitary sewer system at all. In addition, as much as 1 billion gallons of wastewater, 10 arena-sized tanks full, can be forced to overflow upstream of the treatment plant during severe wet weather years.

IMPACTS OF WET WEATHER OVERFLOWS

In locations with severe sewer problems, the wet weather infiltration of storm water into the collection system results in overflows almost every time it rains. Long time residents remember street intersections where conditions have always been bad. The overflowing, floating manhole cover in the street is a common wet weather sight.

The community overflows may be obvious, with dilute raw sewage flooding streets and pedestrian ways, or they may be hidden. Some bypasses are located inside sewer manholes; they divert the sewage flow directly to the storm drain system to keep the streets from flooding. In some places, overflows and backups occur in building basements or on private property. All these flows bypass treatment and ultimately run downhill to community creeks and the Bay.

The goal of the correction program is to **eliminate and prevent** all these overflows and bypasses. First to be eliminated will be the overflows on private property and in community streets. The next priority is to eliminate the overflows into community creeks, and finally, those which overflow directly to the Bay.

Public Health

Sewer overflows are more than mere nuisances or unaesthetic visual scenes. Public health in the U.S. is protected largely by the prevailing high standards for clean water and well established practices for properly treating and disposing of sewage wastes. Where sewage treatment and disposal break down, disease and pollution can pose serious public health threats.

An important aspect of East Bay water quality programs is the sensitive nature of the near shore area. The shallow waters support fragile marsh and mudflat wildlife habitats extending along the shoreline at San Leandro Bay, the Emeryville Crescent, the Berkeley waterfront, and Point Isabel. There are extensive port uses and boating facilities along Alameda, Oakland, Emeryville, and Berkeley waterfronts.

The beneficial uses of the near shore include shellfish harvesting, fishing, water contact sports–wading, swimming, water skiing and sail boarding–and pleasure boating. The potential for contact with contaminated water and raw sewage flows is obvious in view of the intensive uses. East Bay shellfish beds are posted with notices warning the public to avoid eating them. The Department of Fish and Game intends to reestablish the shell fishery and the East Bay Regional Park District plans to develop a linear park along the shoreline.

Bay water quality is affected because the wet weather sewage overflows running downhill in streets to creeks and storm channels end up in the Bay. The health of the bay has long been of regional concern because of the impacts of filling, dredging, and polluting on the shoreline and aquatic habitat. New problems, with toxics from farm drainage and urban runoff, have added to the ongoing concern for the health of the Bay.

Another aspect of East Bay water quality is related to the storm drainage systems. A significant source of Bay pollution comes from untreated urban storm water runoff, collected and discharged by storm drains. Technology and regulations are being developed for this aspect of East Bay wet weather pollution problems. This concern can only be addressed when more information is known; language considered for the reauthorization of the Clean Water Act may mandate needed action.

Regulations and Permits

The San Francisco Bay Regional Water Quality Control Board (RWQCB) regulates Bay Area sewer discharges to protect bay water quality through a permitting system–National Pollutant Discharge Elimination System (NPDES) permits. Violations of permit requirements can lead to building bans and to fines up to $10,000 per day.

The community NPDES permits require eliminating wet weather overflows and bypasses from the sewer collection systems.

The RWQCB encouraged the East Bay communities to cooperate to conduct the joint I/I Study, and to continue progress toward compliance. But until the study information and analyses were available there was no way the communities could make corrections. Now that the study recommendations have been made, and a correction schedule devised, RWQCB permit enforcement will begin. The communities will be expected to demonstrate progress in making the required corrections according to their compliance schedules.

Compliance Plans

The 1972 Clean Water Act set a goal for the nation's waters to be "drinkable, swimmable and fishable" by 1977. In 1977, this original 5-year deadline was extended to 1983, and finally to July 1988. In July 1985, the Environmental Protection Agency (EPA) required the communities to file Compliance Plans with the Regional Water Quality Control Board (RWQCB) to show they would comply by the July 1988 date.

The communities compiled their individual plans and submitted a joint East Bay compliance program on August 1, 1985. The community Compliance Plans are based on the East Bay I/I Study

recommendations and list all the work the communities expect to complete over the recommended 20-year program. The 20-year program schedule was proposed to the RWQCB as the best way to implement the large, costly, and complex project.

The RWQCB will use the Compliance Plans to monitor community progress and to enforce the National Pollutant Discharge Eliminations System (NPDES) permit requirements.

Private Sewer Problems

Private sewer laterals are the small diameter sewers that connect building plumbing to the public sewer mains. Laterals can be divided into two parts; one part on private property, and the other in the public right-of-way.

- The shallow **upper lateral** is located on private property between the building plumbing and the property or easement line; and

- The deeper **lower lateral** is located in the public right-of-way between the property or easement line and the main public sewer in the public right-of-way.

A special pilot project conducted during the course of the I/I Study discovered that private sewer laterals contribute significant amounts, more than 60 percent, of the inflow/infiltration (I/I) to East Bay sewers. This special project also proved that house laterals must be included whenever public sewer improvements are done. **A comprehensive approach is needed to correct I/I problems; nothing less will work.**

Typical lateral problems are missing cleanout caps, broken building connections, illegal downspout connections, tree-root-cracked pipes and root-filled joints, broken pipes, poorly constructed connections, open joints, sags in the pipe line, bad alignment, offset joints, erosion of bedding materials, and often completely collapsed pipes.

Most laterals were found to be too inaccessible for easy TV inspection, testing, and maintenance. Often pipes are broken into to clear blockages because there are no "cleanout" fittings to give access to the upper and lower parts of the lateral. Two-way "Y-shaped" cleanouts can be installed midway in the lateral to give access in two directions from one place. These two-way cleanouts make it easier to maintain, test and inspect private sewer laterals. They should be installed in many areas and will be useful when it is necessary to clear blockages, test for defects and make repairs. They will also remain watertight when not in use.

Cleanout location depends on actual site conditions, for example, whether the sewer main is in an easement or in the street. The communities are working now to develop uniform standards and details which can be adopted to suit each community. This will help cut costs of construction and rehabilitation work. In all cases the codes, standards, and specifications of the community must be followed.

The pilot project recommended several different ways to rehabilitate private sewer laterals. Where defects are so bad it is better to start over, they should be replaced. Where structural conditions allow, a flexible plastic "liner" can be inserted. This technique is called sliplining. Chemical sealing from the inside with a grout compound that hardens to fill relatively small defects was also tried.

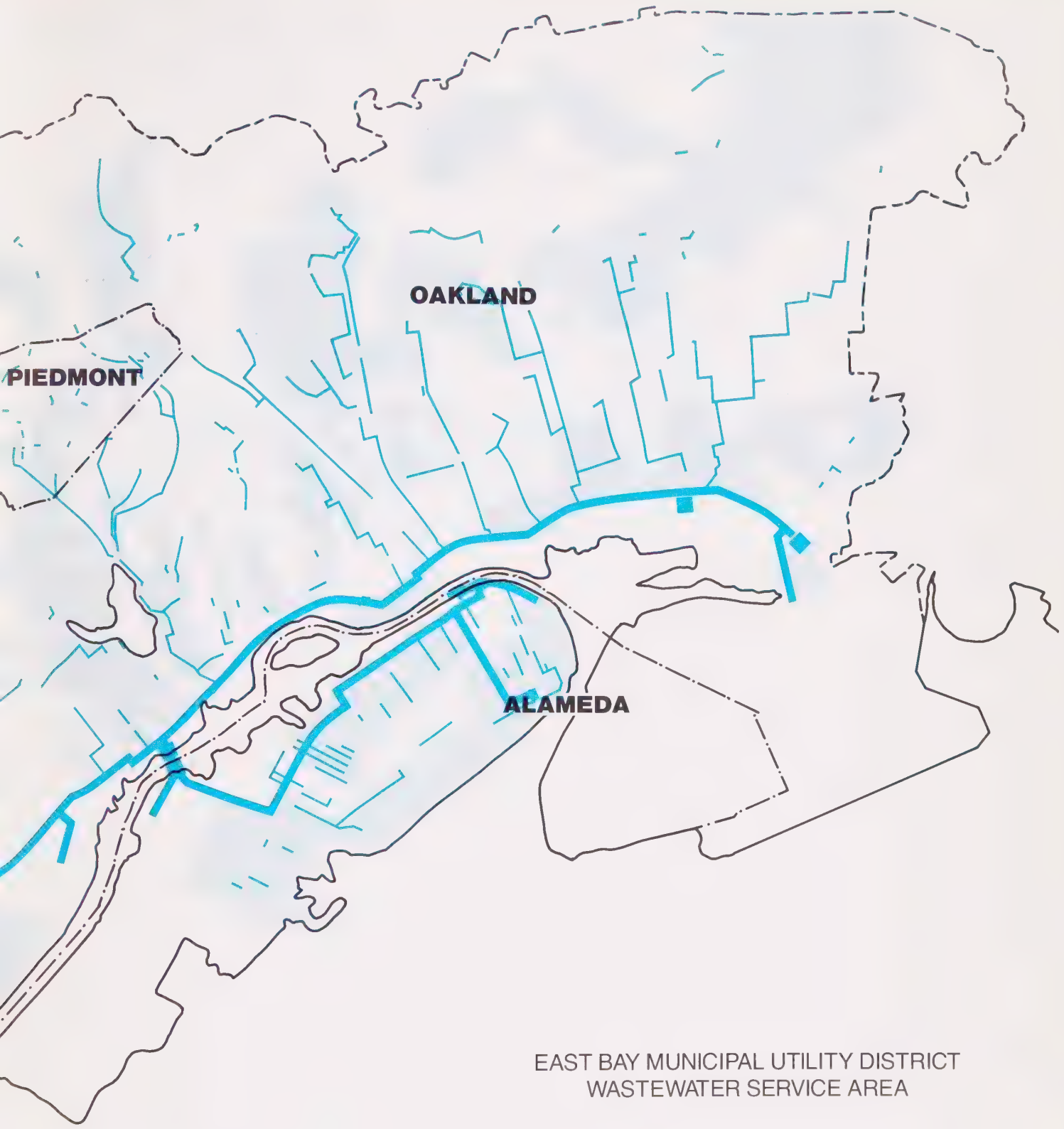
Costs for private sewer rehabilitation are expected to vary from $690 to $3000 for an average (25′ long) lateral and depending on the condition of the lateral, the method used, and the unique site conditions. Chemical sealing was found to be too costly for its short life span; sliplining or replacement have longer life spans and are preferred rehabilitation methods.

Sewer Lateral Programs

The I/I Study recommended that at the same time communities rehabilitate sewer mains they rehabilitate the lower laterals in the public right-of-way and install the needed two-way cleanouts near the property or easement line. At the same time, the upper lateral on private property could also be rehabilitated to complete an effective comprehensive rehabilitation program. After this, the lateral should be tested every 10 years and repaired whenever needed. The two-way cleanout will make inspection and maintenance easier for the private owner.

The upper laterals program will cost $110 million and the sewer main rehabilitation will cost $315 million. Communities are developing programs to assist owners in targeted rehabilitation areas.


N
Kensington
El Cerrito
STEGE
SANITARY
DISTRICT
BERKELEY
ALBANY
Richmond
EMERYVILLE
Wastewater
Treatment
Plant
SAN
FRANCISC



EAST BAY MUNICIPAL UTILITY DISTRICT
WASTEWATER SERVICE AREA

INTERCEPTOR

OVERFLOW STRUCTURES

RELIEF SEWERS

REHABILITATION AREAS

Below left: Crews prepare to pull a seamless plastic lining through existing sewer pipe. This method of rehabilitation can be used where existing pipe has leaky joints and cracks and is otherwise structurally sound. After the lining is in place, special equipment is used to fit and reconnect the smaller sewer laterals to the main pipe. Sliplining is less costly and less disruptive than replacing a pipeline.

Below right: New pipelines must be built to replace damaged sections and to eliminate hydraulic capacity bottlenecks that cause backups and overflows. Trunk sewers in the East Bay range from 24" diameter to this 72" size. Most sanitary sewer mains are 6" to 18" in size while the building laterals are usually 4" diameter.

SOLUTIONS

The communities submitted compliance plans to the RWQCB based on the I/I Study recommendations. The final recommendations, termed Sewer System Evaluation Survey reports, for 20-year community programs have been adopted. A program Environmental Impact Report, which covers the overall 20-year program, has also been accepted and certified. Each year, the communities will update their project schedules to carry out the recommendations of the program.

COMMUNITY PROGRAMS TO CONTROL I/I

Rehabilitation and Relief Sewers

The community I/I control programs rely on rehabilitation of existing sewers and construction of new larger relief sewers over the next 20 years. Overall, 47% of the community sewer system will be rehabilitated and 84 miles of relief sewers built. Rehabilitation costs are $110 million for private sewers, $190 million for community sewer mains and $125 million for relief sewers. Once this work is finished, the communities will need to continue with day-to-day maintenance and regular pipe replacement to make sure that the system doesn't revert to its current state.

Rehabilitation for I/I Correction. Sealing, lining and spot replacement of pipe will be used to give the most cost-effective correction.

- In some places where the sewer is in good condition, a traveling packer will be sent into the sewer pipes to seal and patch leaks and bad joints found by TV inspection with a special quick-setting, watertight grout sealant.

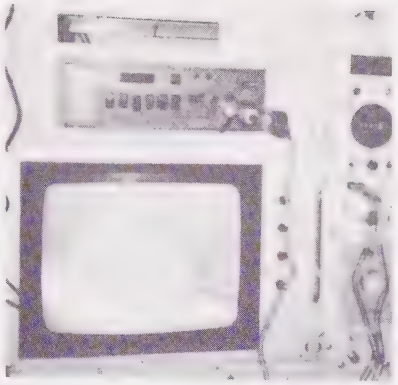
- Wherever possible the sewer pipes will be lined with flexible tubing. Sliplining is one way which pulls a long seamless plastic tube into existing pipes to make a smooth inside lining. Another is to pull an "inside-out cloth sock," into the sewer pipe. Water pressure smooths it to fit. A jet of hot water sets the resin-impregnated cloth, fitting the rigid liner into place–*in situ*.

- Where patching or lining methods won't work, replacement will be needed. Some manholes, fittings and lengths of pipe will be replaced. In some places replacement with the next larger sized pipe will be used to upgrade to the 8"-diameter minimum size standard for modern sewer mains.

Relief Sewers for sewer capacity improvement. Where existing pipe is too small for the flow, communities will either replace with larger pipes or build parallel sewer lines to add capacity.

Long-term Maintenance and I/I Prevention. Long-term maintenance programs will prevent I/I from recurring. These programs will be much more than ordinary emergency repairs for cave-ins or blockages. A new computerized sewer information system which was developed for the I/I Study will alert public works staff to areas that are beginning to develop problems. Whenever the number of complaints or maintenance crew reports indicate that trouble is developing, the problem area will be investigated–flow monitored, smoke tested, television inspected, and scheduled for repair before it goes too far.

Regular cyclic testing and inspection is recommended for approximately 1% of the system each year. Cyclic replacement of over-age and defective sections will be phased in once the worst parts have been fixed in the first 20 years.



Left: TV inspection van parked near manhole pulls a tiny 2" diameter camera through sewers to find cracks and defects needing repair or replacement.

Right: Crew in van interprets and logs information sent to TV monitor by camera traveling in sewer pipe below ground. Later, technicians will analyze the log and video tapes to recommend the most suitable rehabilitation methods for each reach of pipe.

Eventually the sewers will be continually maintained much like the Bay Bridge–when one part is fixed up, the crew will move on the next and the next, eventually starting at the beginning again. By such continual efforts, the sewers can be kept-up to prevent recurrence of the extensive, system-wide backlog of problems we face now.

Overflow Frequency and Volume; Design Storm

The amount of water that sewer systems are designed to hold and convey is determined by the "design flow" selected. The design flows developed for the I/I Study are based on the specific rainstorm of December 5, 1952. This storm came during a time of peak **dry** weather flows when the soil was **already** completely saturated and it dumped 1.57 inches of rain in seven hours . This storm condition represents the third largest flow in thirty-six years of records and using it as the design model will provide considerable protection against future overflows.

Impact on Environment

The disruption caused by installing new relief sewer pipes will be like most large street or public right-of-way construction projects. Residents and businesses in urban settings know this is noisy, dirty and inconvenient; the heavy equipment, trenching, stacks of materials and crews at work are an unwelcome part of urban life adding to traffic congestion and the impossibility of parking.

The recommended rehabilitation methods may limit some impacts, but all necessarily will involve trenching, construction equipment, and work crews. Much of the impact will depend on the areas where work will be done. Is it a high rise area or residential? Are soils rocky and excavations difficult? Are streets narrow and parking impossible? The impact will vary according to conditions residents can best predict.

Related Programs and Costs

Rehabilitation: Infiltration/Inflow Correction Programs. The conventional methods recommended to reduce I/I are to disconnect downspouts and area drains from the sanitary sewer system; but in addition a comprehensive rehabilitation program will be carried out. Comprehensive rehabilitation methods are to line or seal leaky joints in pipes and manholes and to reconstruct the pipe sections and manholes that cannot be repaired.

These 20-year community correction programs will cost $315 million for the public sewer mains. The defective private sewer laterals must also be sealed, lined or replaced; these private repairs will cost $110 million. The overall community investment in the I/I correction program for rehabilitation will be $425 million.

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Relief Sewers: Sewer Capacity Modification Programs. Relief sewers are required to transport the flows that are too costly to completely eliminate. Experience shows that even the most comprehensive programs cannot reduce I/I more than 70%. In some places only building relief sewers to expand system capacity and to eliminate hydraulic bottlenecks will work. These sewer capacity expansion programs will cost $125 million.

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District Wet Weather Facilities Plan. After the community capacity improvements are complete wet weather flows will be conveyed to the interceptor instead of overflowing upstream in community streets and creeks. The District interceptor must be able to have the capacity to handle these new larger flows.

The 1985 Wet Weather Facilities Plan Update considers four approaches for controlling overflows. Included in most of the alternatives are new diagonal interceptors running from the District's existing interceptor into the communities' worst problem areas. This would put the capacity for flows close to their source; the needed relief sewers would be shorter and save construction costs. The costs of such facilities would be shared by the communities and the District.

The relief sewer programs in the communities must be coordinated with the District's wet weather facilities program because until District facilities are complete, the communites may not be able to hookup their relief sewers to the interceptor. The interceptor is already flowing full and it could backup creating new overflows and causing new problems in other areas.

The expanded community sewers will deliver to the interceptor system all the wastewater that previously overflowed in community streets. It can cost between $67 and $440 million, depending upon the level of treatment required, to increase interceptor capacity to carry these flows. The District is currently developing the treatment level required and the kind of facilities needed; construction of the District capacity is scheduled to begin in 1988.

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Long-term maintenance programs. Controlling infiltration/inflow will become a new emphasis for maintenance programs. Infiltration/inflow control must begin now in order to preserve the gains made and prevent I/I problems from recurring. Each community will routinely use the I/I study methods–smoke testing, dye-tracer testing, television inspection and flow monitoring–to find souces of I/I. Once found, the problems can be corrected as part of an ongoing I/I control program.

The program will schedule rehabilitation or replacement for those pipelines and manholes past their useful lives of 50-100 years. This regular cyclic rehabilitation and replacement of worn-out parts of the sewer system will be important to control I/I for the future. These on-going cyclic replacement and I/I control programs will cost $15-30 million annually.

Comments on the Environmental Impact Report (EIR) and suggested mitigation measures have been sought through public reviews and hearings. An EIR was prepared that covers the overall regional program. It will be reviewed annually. If, during this annual review, conditions are substantially different in any special areas, a supplemental environmental documentation will assess those special site conditions.

Costs for District Wet Weather Facilities have been estimated at $145 million and will be reflected in increased District treatment charges. The increases could raise existing $5.60 per month fees to between $8 and $14 depending on the amount of grant funding received.

Positive impacts on the environment will be felt as the 20 year program of repairs and corrections nears completion. At first, overflows will only be shunted out of community streets. Next they will be prevented from running into community creeks. Finally, there will be **no** overflows or bypasses to impair Bay water quality.

Impact on Rates and Charges

The community capital improvements planned will have significant economic impacts. The low sewer charges collected by communities, which now range from $1.00 to $7.00 per month, will increase substantially to pay for the program. Last year's increases ranged from 20% in Emeryville to 244% in Albany. At present, Piedmont has the highest sewer collection charges.

If I/I corrections were fully funded with pay-as-you-go methods, $18/month sewer fees might be required for some communities. It is expected however, that a mix of financing methods will be used.

District costs will also have an impact on local sewer fees. In addition to community increases, the District charges for its related wet weather facilities could increase over $8.00 per month. The District has a financing study underway to determine the most equitable ways to pay for wet weather improvements.

Grants

The District and the communities are applying for Federal and State Clean Water grant funds that can be used for collection systems. If the joint application for the Easy Bay communities is successful, up to $28 million could be come available for the communities each year until grant funds run out, some time in the early 1990's. Additional funding is also being pursued for the District's wet weather facilities.

RELATED DISTRICT ACTIVITIES

Water Quality Protection–Interim Measures

While the communities correct their overflow problems, the District must increase its system capacity–from 300 million gallons per day (MGD) to almost 800 MGD. This is needed to accommodate the larger community flows which, after the 20-year program is complete, will no longer overflow upstream. Meanwhile, in making its plan for larger facilities, the District must develop a plan for treating these infrequent wet weather flows to the proper level required to protect the Bay during the 20-year interval before the correction program is completed.

Because the existing range of treatment standards for wet weather overflows is broad, the District plans to apply for a revised NPDES permit as a way to get definite regulations. At present the San Francisco Basin Bay Plan requires "treatment to the level required to protect the beneficial uses of San Francisco Bay."

Clearer standards are needed to define exactly what must be done to protect the sensitive east shore environments of the Bay–the special shoreline places like Arrowhead, Elsie Roemer and Hoffman marshes, San Leandro Bay, the northern shoreline and Pt. Isabel. Properly defined standards, considering the nature of the estuary and local water quality conditions, will establish specific levels of treatment.

Capital Costs

Alternative facilities ranging in cost from $67 to $440 million are being evaluated as part of the District's wet weather predesign efforts.

1. **Providing federally mandated treatment for all wet weather flows** would require storage facilities large enough to contain all peak wet weather flows. Storm flows would be held until the storm passed when they could be conveyed safely to the treatment plant. This plan would cost $440 million.

2. The improvements needed to **provide treatment for all wet weather flows and to protect beneficial uses,** would cost $145 million.

3. The costs to **provide hydraulic improvements only** would be $67 million.

So far the $145 million project appears to be the best alternative.

COMMUNITY AND DISTRICT PROGRAMS COMBINE NEEDED IMPROVEMENTS FOR ENTIRE REGION

TOTAL COSTS FOR IMPROVEMENTS NEEDED FOR ENTIRE REGION

☐ REHABILITATION	
PRIVATE SEWER LATERALS	$110 MILLION
COMMUNITY SEWERS	$190 MILLION
☐ CAPACITY IMPROVEMENTS/RELIEF SEWERS	$125 MILLION
☐ DISTRICT SYSTEM IMPROVEMENTS	$145 MILLION
☐ **TOTAL COSTS**	**$570 MILLION**

IMPLEMENTATION PLANS IN PROCESS

Lateral Programs

Building laterals must be rehabilitated so the main line sewer repairs can be effective. The communities are developing programs and policies to help owners with lateral rehabilitation.

They are working to develop uniform testing and inspection methods, construction standards and details which can be incorporated into existing community codes. They are working to develop funding programs and policies to give financial assistance where necessary.

Communities are developing and evaluating special programs which might allow construction to be done all at once on both the public and private parts of the system. A menu of programs from which to select is also being developed so each area can have choices.

Joint Powers Agreement (JPA) Amendment

A Joint Powers Authority with all seven communities and EBMUD was established in 1979 to conduct the East Bay I/I Study. This agreement was amended in January 1986 and extended for 5 years to allow for coordination of the construction and correction program.

EBMUD will continue to serve as lead agency for administration and continue its coordinating role.

All grant funds received will be administered and distributed through the JPA. Community councils will continue to authorize specific projects and control individual project spending.

Uniform Standards

A team of experts and city specialists worked together to develop common region-wide sewer construction standards. These will replace the existing confusing requirements which are different for each jurisdiction. Now uniform construction specifications and standard details will be available in each community building code, plumbing code or sewer ordinance. Uniform survey data formats, drawing sizes, and title blocks will be used to the greatest extent possible so joint submittals for design approval, permits and grant funding can be expedited.

What Is Being Done:

There is a large backlog of sewer improvement projects needed in each community in the Special District No. 1 service area. Communities are revising their funding programs to meet these backlogged needs.

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The communities are applying for grant funding for key projects in each community where early improvements for the worst conditions will be most effective.

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The communities are adopting new and upgraded programs in three general areas: infiltration/inflow (I/I) correction (rehabilitation), sewer capacity modification (relief sewers), and long-term maintenance to prevent I/I from recurring in the future.

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The communities will continue cooperative efforts in the future. They are establishing uniform standards and procedures for construction and rehabilitiation. They will study and adopt equitable methods of paying for the improvements. They are developing policies to assure rehabilitation of private laterals.

Local Effects Monitoring Update

Defining the treatment standards needed to protect the beneficial uses of San Francisco from wet weather overflows requires detailed study of the aquatic habitat of the Bay. In 1982 the District completed a 3-year data gathering program to find out how its wet weather overflows from the interceptor affect the local shoreline and Bay waters. Near-shore monitoring of bay organisms and habitats was updated during wet weather in 1985-86.

Although similar, the 1980-1982 local effects monitoring data are incomplete because 1980-1982 proved to be very dry years. The new, more complete 1985-86 information will be incorporated into the application for the revised District NPDES permit. These data will help the RWQCB to define the appropriate standards for the District's wet weather facilities.

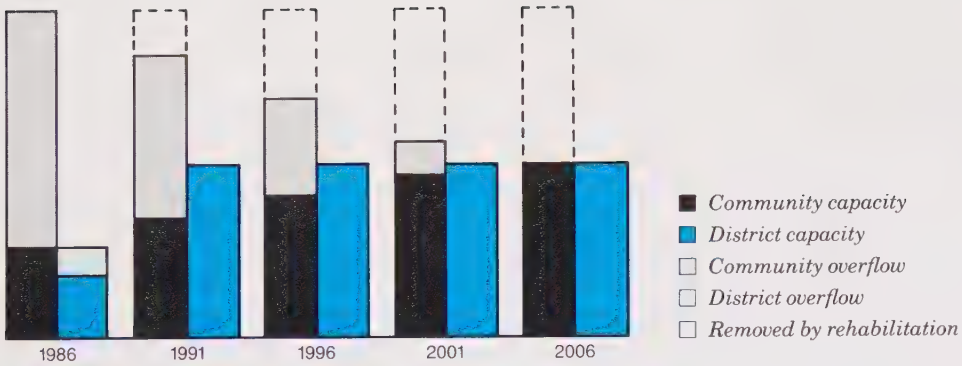
Financing Study

The District is conducting a study for identifying methods of financing the wet weather improvements. Consideration is being given to different ways to allocate and collect charges for capital improvements and major infrastructure repairs to separate them from the charges for ordinary operations and maintenance costs. One suggestion for collection is to separate these charges on the tax bill or on customer bills. Other ways to pay for wet weather improvements will be investigated. All suggestions will be evaluated to devise systems that are equitable.

SUMMARY OF COMMUNITY PLANS: COMPLIANCE PLANS AND 20-YEARS PROGRAMS

Community Facilities

Communities will build 84 miles of relief sewers to upgrade capacity and eliminate bottlenecks. They will rehabilitate 47% of their collection systems by sealing leaky joints and lining or replacing



defective pipes. An estimated forty-seven percent of building laterals will also be replaced or rehabilitated.

Compliance Plans

Community Compliance Plans were filed with the RWQCB in August 1985. The purpose of the plans is to demonstrate how and when the communities will comply with federal law. The plans show detailed implementation schedules for each community. The RWQCB has begun administrative action to enforce the law by issuing **Cease and Desist** orders to each community. An annual review and update will require each community to demonstrate progress and to submit the next year's work schedule.

20-Year I/I Correction Program

A 20-year program was selected to allow for the best financing terms and to minimize disruption from construction activities.

The first year of the program, 1986, will include 47 projects throughout the area to correct the worst trouble spots. Rehabilitation work will begin the effort to compress 100-years of neglected maintenance needs into a 20-year catch-up program. Relief sewers for more capacity will be constructed to eliminate the system bottlenecks and potential public health risks.

Community Costs

The total costs of $425 million will be borne 60% by Oakland, 23% by Berkeley and 17% by the five smaller communities. Community costs will change as projects are defined more specifically since costs depend on the actual structural conditions and rehabilitation methods. Cost effectiveness evaluations will be updated once the District regional wet weather facilities are final. Some communities will adopt policies to upgrade minimum sewer pipe sizes; others will share costs for jointly used facilities or projects.

Need for District/Community Coordination

In January 1986, the communities amended the Joint Powers Agreement (JPA) under which they conducted the I/I Study. The amended JPA will allow them to continue their cooperative efforts during construction and to quality for grant funds to carry out the I/I Correction Program. The District will continue as lead agency for grant administration and coordination.

Coordinating community and District efforts will ensure the best timing of projects. District facilities must be ready before communities can connect their new relief sewers. Engineering data and designs must be shared so the facilities will work together. Uniform standards will make construction easier and less expensive. Inter-community agreements are needed to define responsibilities and construction cost sharing of joint benefit facilities.

The rapport and working relationships built over the study years will continue to be important as the communities continue to share costs, equipment, data and expertise. Easy cooperation and coordination between existing agencies means lower costs and more efficiency for the region. I/I Study opinion research showed there is little public sympathy for creating more layers of government to conduct the I/I Correction Program, but there is a great desire for local control with regional cooperation.

What Can You Do?

Your comments and suggestions for mitigating environmental impacts are important to the success of these extensive programs. Please write or call the East Bay I/I Correction Program staff or your community public works department if you can help. The phone numbers are listed on the back cover for convenience.

- ○ Look for announcements and notices of meetings and hearing to discuss I/I correction programs and wet weather facilities. Call or write to tell us about your comments and suggestions and to discuss any issue of special interest.
- ○ Learn about sewer conditions in your area. Report trouble or overflows to your community Department of Public Works or sewer agency.
- ○ Find out where your sewer lateral is located, when it was built and if it has a two-way cleanout.

We want you to know that your cooperation in this Study has been appreciated. The I/I Study tested thousands of miles of sewers in East Bay neighborhoods and met thousands of understanding and helpful neighbors. Our opinion research (and our experiences) showed East Bay residents are unusually aware of the I/I Study, well-informed about wet weather problems, and willing to cooperate in achieving recommended solutions.

The East Bay communities must rely on your cooperative spirit and continuing goodwill to achieve the difficult and costly programs needed for our future together.

GOALS

Least Cost Regional Solution

Only a coordinated effort will achieve the lowest overall costs for the region. Improving the East Bay sewer system is going to take a long range community commitment to rehabilitation programs. The 20-year program can restore the system to meet public health and safety standards. Steady progress over a long time will accomplish the basic program goals:

- ○ first, to keep overflows out of the community streets;
- ○ next, to keep overflows out of community creeks;
- ○ and finally, eliminate overflows to the Bay.

The first 5 years of the 20-year program will spend the greatest attention to reduce overflows near schools, hospitals, recreation areas and shopping areas. The following years will attend to the other program areas. When completed, the 20-year program will eliminate *all* wet weather overflows and bypasses.

Once the sewer system is restored, the long term community commitment to its infrastructure must continue. The system must be kept up to anticipate potential problems that can cause deterioration. Defects must be detected and corrected on a regular schedule.

The perpetual preventative maintenance program will ensure the I/I problems do not recur. Cyclic replacement and continued rehabilitation will be done as needed. This long range program recognizes the infrastructure maintenance needs defined by the I/I Study.

A major goal is to use grants and aid programs wherever possible to assist with costs and to ease the financial burden of long range major improvements. The needed long range commitment to paying for infrastructure needs will be phased in.

The regional philosophy of cooperating to achieve overall lowest cost is a major program goal. This long-range program will eliminate public health threats, contribute to improved Bay water quality for East Bay communities, and establish effective infrastructure management programs.

Cost Effectiveness and Lowest Regional Cost

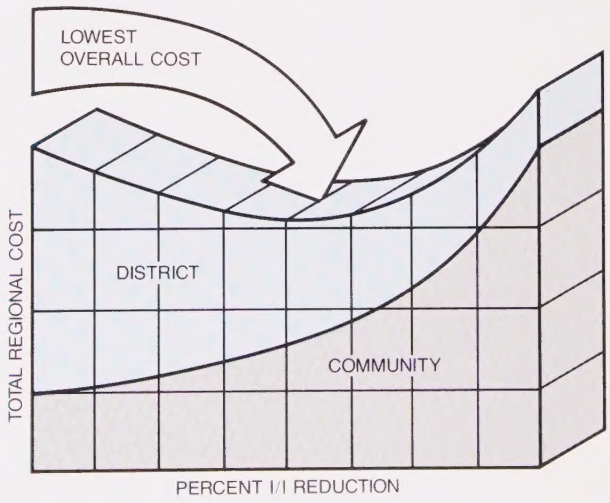
The I/I Study recommendations were ranked according to cost effectiveness. This method was developed to standardize costs and calculations so the cost figures throughout the study area could be compared. In some cases, it would cost more to rehabilitate than to convey the extra flows for treatment. In other cases it is so expensive to convey flows, it is far better to eliminate them. This analytic method is important as the way to find the *lowest total regional cost* because the same East Bay users will pay for *both* community and District improvements.

The recommendations provide for the lowest cost regional solution. If the communities were to do all they possibly could to correct I/I, the District could then do less, but the total regional cost would be much higher. If however, the communities did less, and the District increased facility sizes to accommodate uncorrected community flows, the regional cost would also be higher.

Instead of choosing these extreme costs the lowest regional cost was selected at a point where:

- ☐ the communities reduce I/I by approximately 30% overall; and
- ☐ the District builds larger facilities to accommodate the I/I corrected flows;

The lowest overall cost to be paid by the total region is a combination of the District and Community costs.



Costs:

The costs to meet current regulations for controlling sewer overflows will approach one half billion dollars. Oakland will bear more than 60% of this cost and Berkeley nearly 23%. The remaining 30% will be borne by Alameda, Albany, Emeryville, Piedmont and the Stege Sanitary District.

Timing:

The total number of projects is so large and the potential disruption so great that 20-year programs are needed. After that, on-going preventative maintenance programs will take over to prevent the wet weather problem from recurring.

The recommendations of the East Bay Infiltration/Inflow Study, a California Clean Water Grant project, are now being carried out by the East Bay Infiltration/Inflow Correction Program. This sewer improvement program is conducted by a joint powers authority of the communities of Alameda, Albany, Berkeley, Emeryville, Oakland, Piedmont, and the Stege Sanitary District, which serves El Cerrito, Kensington, and part of Richmond and the East Bay Municipal Utility District. East Bay Municipal Utility District serves as lead agency for coordination, grant administration, and financial management. Each community is responsible for construction of its own facilities.

EAST BAY INFILTRATION/INFLOW CORRECTION PROGRAM

P.O. Box 24055 Oakland, CA 94623

ALAMEDA	ALBANY	BERKELEY	EMERYVILLE	OAKLAND	PIEDMONT	STEGE SANITARY DISTRICT
522-4100 Ext 272	528-5760	644-6540	658-8732	273-3437	420-3050	524-4667

EAST BAY MUNICIPAL UTILITY DISTRICT, LEAD AGENCY
465-3700

EAST BAY
INFILTRATION/INFLOW
CORRECTION PROGRAM